<u>WHAT IS CLAIMED IS:</u>

1.   1.   A method for placing circuit elements into logic blocks, the method
2   comprising:
3   assigning each of the circuit elements to a separate abstract block, wherein the
4   circuit elements are part of a user design for a programmable integrated circuit;
5   grouping each of the abstract blocks into a logic block;
6   removing a first one of the abstract blocks from a logic block in response to
7   placement information that indicates a design goal would be improved by rearranging at least
8   a portion of the user design; and
9   placing the first abstract block into a different logic block on the
10   programmable integrated circuit.

1.   2.   The method according to claim 1 wherein the design goal includes
2   routability and signal timing in the user design.

1.   3.   The method according to claim 1 wherein the circuit elements include
2   lookup tables and registers.

1.   4.   The method according to claim 1 wherein the circuit elements include
2   DSP blocks and RAM blocks.

1.   5.   The method according to claim 1 further comprising:
2   determining whether placing each circuit element into the logic block violates
3   any of a set of design rules relating to the logic block, wherein the logic blocks are grouped
4   into clusters; and
5   determining whether placing each of the circuit elements into a cluster violates
6   any of a set of design rules relating to the cluster.

1.   6.   The method according to claim 5 wherein each of the abstract blocks
2   are grouped into a cluster based on an attraction of the abstract block to the cluster, and the
3   attraction measures a number of nets and connections of nets absorbed into the cluster if the
4   abstract block is placed inside the cluster.

1.   7.   The method according to claim 5 wherein each of the abstract blocks
2   are grouped into a cluster based on an attraction of the abstract block to the cluster, and the

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3   attraction measures a number of timing critical connections absorbed into the cluster if the
4   abstract block is placed inside the cluster.

1   8.   The method according to claim 5 further comprising:
2   placing one of the abstract blocks into another logic block within the cluster if
3   placing that abstract block into the logic block violates any of the design rules relating to the
4   logic block; and
5   placing one of the abstract blocks into another cluster if placing that abstract
6   block into the cluster violates any of the design rules relating to the cluster.

1   9.   The method according to claim 1 wherein the logic blocks implement
2   functions performed by two lookup tables with less than k unique input variables; and the
3   method further comprises:
4   determining whether placing each of the abstract blocks into the logic blocks
5   causes any of the logic blocks to have more than k unique input variables.

1   10.   The method according to claim 1 wherein the placement information
2   includes floorplanning information.

1   11.   The method according to claim 1 wherein the placement information
2   includes partition information.

1   12.   The method according to claim 1 wherein the placement information
2   includes data obtained by placing a portion of the user design on the programmable integrated
3   circuit.

1   13.   The method according to claim 1 wherein:
2   grouping each of the abstract blocks into a logic block further comprises
3   grouping first and second abstract blocks into a first logic block;
4   removing the first one of the abstract blocks from the logic block further
5   comprises removing the first abstract block from the first logic block; and
6   placing the first abstract block into a different logic block further comprises
7   placing the first abstract block into a second logic block and placing the second abstract block
8   into the first logic block.

1	14. A computer program product stored on a computer readable medium
2	for placing circuit elements in a user design for a programmable integrated circuit into logic
3	blocks, the computer program product comprising:
4	code for assigning each of the circuit elements to a separate abstract block;
5	code for grouping each of the abstract blocks into a logic block;
6	code for determining whether placement information indicates that a design
7	goal would be improved by moving at least one of the abstract blocks into a different logic
8	block; and
9	code for removing the at least one abstract block from a first logic block and
10	placing the at least one abstract block into a second logic block in response to the
11	determination based on the placement information.

1	15. The computer program product as defined in claim 14 wherein the
2	design goal includes signal timing and routability in the user design.

1	16. The computer program product as defined in claim 14 wherein the
2	logic blocks are grouped into clusters of logic blocks, and the code for grouping each of the
3	abstract blocks into a logic block further comprises code for grouping each of the abstract
4	blocks into a cluster of logic blocks based on an attraction of the abstract block to the cluster.

1	17. The computer program product as defined in claim 16 further
2	comprising:
3	code for determining whether grouping the abstract blocks into the clusters
4	violates any design rules of the clusters; and
5	code for determining whether grouping the abstract blocks into the logic
6	blocks violates any design rules of the logic blocks.

1	18. The computer program product as defined in claim 14 wherein some of
2	the circuit elements are lookup tables, and some of the circuit elements are registers.

1	19. The computer program product as defined in claim 16 wherein the
2	attraction measures a number of nets and connections of nets absorbed into the cluster if the
3	abstract block is placed inside the cluster.

1   20.   The computer program product as defined in claim 16 wherein the

2 attraction measures a number of timing critical connections absorbed into the cluster if the

3 abstract block is placed inside the cluster.

1   21.   The computer program product as defined in claim 17 further

2 comprising:

3   code for placing one of the abstract blocks into another logic block if placing

4 that abstract block to the logic block violates any of the design rules relating to the logic

5 block.

1   22 .   The computer program product as defined in claim 17 further

2 comprising:

3   code for placing one of the abstract blocks to another cluster if placing that

4 abstract block to the first cluster violates any of the design rules relating to the first cluster.

1   23.   The computer program product as defined in claim 14 further

2 comprising:

3   code for determining whether placing the abstract blocks to the logic blocks

4 causes any of the logic blocks have more than k unique input variables,

5   wherein the logic blocks are configurable to implement functions performed

6 by two lookup tables with less than k unique input variables.

1   24.   The computer program product as defined in claim 14 wherein the

2 placement information includes floorplanning information.

1   25.   The computer program product as defined in claim 14 wherein the

2 placement information includes partition information.

1   26.   The computer program product as defined in claim 14 wherein the

2 placement information includes data obtained by placing logic blocks that implement

3 portions of the user design on the programmable integrated circuit.